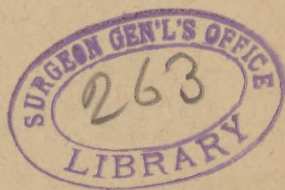


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THE
REMOVAL OF FOREIGN BODIES

FROM THE
INTERIOR OF THE EYE.

BY
H. KNAPP,
OF NEW YORK.

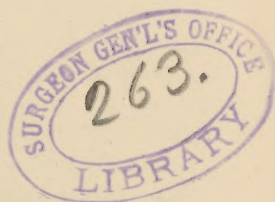


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Nos. II., III. and IV.*

NEW YORK:
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THE REMOVAL OF FOREIGN BODIES FROM THE INTERIOR OF THE EYE.

By H. KNAPP.

IN the year 1862, shortly after the opening of the "Ophthalmic Clinic" at Heidelberg, Prof. Esmarch honored me and the institution with a visit.

CASE I.*—*Piece of steel in lens removed with probe bent in the shape of a hook.*

Among the patients there was one whose cornea had been pierced, several days before, by a little piece of steel, which had been arrested in the crystalline lens, quite close to the inner pupillary edge. The eye being greatly irritated, the lens swollen and, of course, opaque, I thought it necessary to remove the foreign body, one corner of which could just be seen at the edge of the iris. I made a large corneal section, and tried several times to seize and extract the foreign body by means of forceps, but always failed, then Esmarch asked me, "Will you not try a curette?" "There is none at hand," I replied. "Then let's make one," said he, and taking a Bowman's probe, he bent its end and handed it to me. I passed the curved end behind the foreign body, which I drew without difficulty into the corneal wound, where it was easily seized and extracted with a pair of anatomical forceps.

Then I removed as much cataractous substance as could be evacuated by depression of the posterior lip of the wound and gentle counter-pressure on the outer surface of the cornea.

The wound healed, and, by a subsequent iridectomy, with which also a small piece of the pupillary pseudo-membrane was removed, the eye acquired tolerably good vision.

Prof. Esmarch, in the pursuit of his great and beneficial

* NOTE.—All the cases interwoven in this paper that are printed in small type and marked with successive numbers have occurred in my own practice, whereas those cited from literature are printed in the type of the context.

objects, the accomplishment of which has added so much glory to his name, has, no doubt, long since forgotten the little scene of the foreign body in the lens, but his advice, the appropriateness of which he demonstrated to me *ad oculum*, had deeply impressed me, and whenever afterward I had to deal with the removal of a foreign body from the eye, I used the curette by preference, and in some cases obtained with it the most fortunate results.

Surgeons have known for a long time that, in the removal of foreign bodies from narrow canals and cavities, curette-shaped instruments are very appropriate, but in ophthalmic practice they seem to be less extensively used than they ought to be. This statement I base on repeated evidence obtained in my travels, and beg to present only two corroborating examples.

In the year 1868, I visited one of the most celebrated ophthalmic clinics of the European continent, the surgeon of which is one of the most esteemed operators. In the hospital I saw a case the very counterpart of the one described above. A little piece of stone had pierced the cornea, and lodged, visible, in the opaque and swollen lens. The operator made several unsuccessful attempts to extract the foreign body with toothed and anatomical forceps. At last he succeeded by means of a spoon. The witnessing of these attempts affected me unpleasantly, and I would fain have reminded the operator of the value of the curette, but being the younger man, and for reasons of etiquette, I refrained. When I saw the eye again it was a ruin.

Not long after this, in one of the London ophthalmic hospitals, I saw a patient in whose iris a little piece of iron was imbedded. When the surgeon, with whom I was upon very friendly terms, had made several unsuccessful attempts to seize the foreign body with forceps, pushing it the more deeply into the iris, I suggested to him to use a curette, which advice he gladly followed and extracted the piece of iron without difficulty.

After these introductory remarks, I may be permitted to proceed to a comprehensive compilation of the results of my own experience, supplemented by a critical consideration of the literature of the subject, as far as it was accessible to me.

A.—FOREIGN BODIES IN THE ANTERIOR CHAMBER.

Foreign bodies are met with in all the walls of the anterior chamber, but I have never seen them suspended in the aqueous humor.

I. *Foreign Bodies in the Cornea projecting into the Anterior Chamber.*

From my own experience I remember only two such cases.

CASE II.—*Small piece of stone impacted in the cornea and projecting into the anterior chamber, pushed back with forceps and removed.*

The first (which I copy from my Heidelberg case book) relates to a working man, Caspar Schmidt, æt. 56, of Dossenheim near Heidelberg, who was admitted to the clinic June 26th, 1866.

A small, triangular piece of stone lodged with its base in the cornea, and projected, with point directed obliquely upward, into the anterior chamber. It could not be seized from without. I therefore made with the lance-knife an incision in the upper part of the cornea, introduced a pair of anatomical forceps, seized the little stone at its apex, and tried to draw it out through the anterior chamber. But the foreign body not yielding to the traction, I pressed it back against the cornea until its base projected so far that it could be seized and extracted with forceps. The canal of the wound, appearing unclean, was enlarged and freed of all adherent particles of sand. In the evening I found the iris adherent to the place of perforation, the pupil wide, and in the centre of the anterior capsule a circumscribed white opacity.

June 27th.—No reaction ; no synechia ; the opacity on the lens capsule had disappeared.

June 28th.—Cornea in the tract of wound opaque, everywhere else clear ; no anterior synechia left ; all vascular irritation had disappeared. Patient was discharged cured.

CASE III.—*Small piece of steel projecting through the cornea into the anterior chamber removed with hook.*

In the other case, a needle-shaped piece of steel had entered the cornea in its outer and lower quadrant, $1\frac{1}{2}$ ''' below its centre ; one end of it remaining impacted in the cornea, the other projecting from 1 ''' to $1\frac{1}{2}$ ''' obliquely inward and slightly upward into the anterior chamber.

The patient was a young workman in an engine shop of New York, and the injury had happened only a few hours before he came to me.

The anterior chamber was filled; the pupil regularly round and movable; the sight good; no opacity of the cornea, but lachrymation and moderate conjunctival injection. The outer end of the foreign body appearing to be near the posterior surface of the cornea, I made no attempt to remove the foreign body in the usual way, being afraid of pushing it entirely into the anterior chamber, where it would have fallen either on the iris or into the sinus between iris and cornea, and from where its removal would have been much more difficult. I therefore made, with a Beer's cataract-knife, a small corneal incision $1\frac{1}{2}''$ – $2''$ below the foreign body, letting the aqueous slowly escape. Then I introduced a broad hook from the outer side over the superior edge of the foreign body, and extracted it at the first attempt. The iris had not protruded, and the pupil remained round. I instilled atropine and applied the ordinary bandage. In a few days the eye recovered with entire preservation of sight and without synechia.

From personal intercourse with other oculists, I have received the impression that curette-like instruments are hardly, if at all, used for the extraction of foreign bodies from within the eye, but in literature I find them repeatedly mentioned. In Mackenzie's treatise,* two observations are recorded which are similar to the one just related, and in which Mackenzie had employed a blunt hook.

In the first case, a small piece of metal had struck the eye of a workman, and twelve days later Mackenzie noticed a splinter of brass, $1\frac{1}{2}''$ in length, on the inner face of the cornea. No lesion of the cornea was visible as yet, but there was considerable iritis, which Mackenzie in part subdued by belladonna and antiphlogistic treatment. He then made with a Beer's cataract knife a corneal incision $2\frac{1}{2}''$ to $3''$ in length, and $1\frac{1}{2}''$ above the transparent edge of the cornea, leaving the blade of the knife in the eye until the aqueous had partially escaped, thus preventing prolapse of the iris. He then introduced a small hook, drew the splinter over the inner surface of the cornea into the wound, where it was easily extracted. Perfect recovery.

In the second case, a thorn rested with the thicker end in

* Cases 247 and 248, p. 394, 4th London Ed.

the cornea, with its thinner in the iris; the injury occurred three weeks previously; the corneal wound was closed, and the eye showed but moderate irritation. Mackenzie opened the anterior chamber at its temporal edge, the thorn being situated near the nasal edge. With a Schlagintweit's hook he was unable to detach it from the cornea. During the attempt to extract it, the iris was torn and the eye filled with blood.

Nothing else is mentioned of the patient, and it is not unfair to presume that his eye was lost.

In the first case of Mackenzie, the foreign body rested only in the cornea, and projected obliquely into the chamber; in the second, it rested in the cornea and the iris, that is, both in the anterior and posterior walls of the anterior chamber. This case reminds us of the necessity of caution, dwelt upon by different authors, as to the danger of wounding iris and lens, during attempts at removal of foreign bodies lodged with one end in the cornea, while the other projects free in the anterior chamber. Zehender says, in his text-book of ophthalmology: * "To avoid this danger, Agnew† thrust a Beer's cataract knife on one side of the foreign body into the cornea, and caused it to emerge on the other, so that the projecting point of the foreign body was opposed to the blade of the knife, which afforded the foreign body a firm support, thus obviating the danger of the foreign body falling into the anterior chamber during its removal in the ordinary way. I have, under similar conditions, thrust a broad discission needle at the proper place into the cornea, and with its surface pushed the projecting point from within outward, whereby the foreign body fell almost by itself out of the hole which it had bored. In a similar manner George Lawson has operated in similar cases."

The two cases reported by Lawson are instructive.‡ In the first, a chip of metal, $1\frac{1}{2}$ lines in length, lodged deeply in the

* 3d Ed., 1876, vol. 2, p. 588.

† New York Medical Record, Vol. I., p. 251, 1866. "A Method for Removing a Foreign Particle from the Cornea." Dr. C. R. Agnew kindly informs me that since the above publication he has several times successfully employed the same method.

‡ London Ophth. Hosp. Rep., pp. 36 to 38, 1867.

cornea, and projected so far into the anterior chamber that it seemed almost to touch the lens. Its outer end could be felt with a probe under the epithelium. It could not be seized from without. Dr. L., therefore, introduced a broad needle into the anterior chamber, pressed with its broad surface the chip of iron back toward the cornea, where an assistant seized and extracted it. "The splinter of metal must have injured the lens, since the lens was cataractous."

The second case resembled the first; the foreign body, however, was a thorn which bent when Lawson attempted to press it back with the surface of a broad needle introduced into the anterior chamber. L. therefore enlarged the corneal wound made by the needle, seized the thorn at its point in the anterior chamber, and drew it out. In doing this, the iris was injured, and consequently the piece involved drawn out and cut off. Recovery with preservation of sight.

The introduction of a broad needle, or of a cataract knife, into the anterior chamber has a double object.

1st. To protect the iris and lens during the different manipulations for the removal of foreign bodies. This is very important, and should never be omitted when foreign bodies project into the anterior chamber. I would recommend that the surface of the instrument be held obliquely, so that the foreign body could not fall into the sinus of the chamber.

2d. By pressure from behind to push the foreign body out again.

This can, of course, only be accomplished if the foreign body is hard and almost perpendicularly placed in the cornea.

A broad needle, one surface of which is slightly hollow, might be used with greater advantage, the foreign body being less likely to slide away from it. This device to protect the iris and lens and preventing a foreign body from falling into the anterior chamber, seems to be tolerably well known, since it is mentioned in several text-books. R. B. Carter says that it was originated several years ago by Dixon (opening of the cornea near its periphery with a broad needle, introduction of a blunt spatula behind the foreign body). Arlt, in his excel-

lent treatise "On the Injuries of the Eye and their Medico-legal Aspect,"* says that he has introduced a Daviel's spoon through a lateral corneal opening behind the body in the anterior chamber, and either pressed it back or at least so steadied it that he could safely seize it. Desmarres† alleges that he has devised a procedure which in many cases did him good service. He passes his paracentesis needle behind the foreign body, keeps it gently pressed against the cornea so that no aqueous can escape, then cuts with a cataract knife through the corneal tissue along and in front of the foreign body, prying the latter out as soon as it has become loose. These last-mentioned procedures are less to be recommended than that of the cataract-knife and the broad needle.

II. *Foreign Bodies upon and in the Lens.*

Of foreign bodies lying upon the lens, that is, on the capsule in the pupillary space, I know only one example; it refers to a case in my own practice. I may, therefore, be permitted to report it here exactly according to the notes in my case-book made at the time.

CASE IV.—*Chip of iron on the anterior capsule; successfully removed with forceps.*

George Merckert, æt. 40, of Ingenheim near Landau, presented himself on June 25th, 1867, in my clinic at Heidelberg, with the following history: Sixteen years previously, a small piece of iron struck his left eye. After the irritation immediately following it had passed, the eye remained healthy until Nov., 1866, when, one day, something flew into his eye again, "but the affair didn't amount to anything." Since Feb., 1867, the eye has been painful and red. *Condition upon admission:* Marked circumcorneal injection; photophobia; iris swollen, dull; upper and inner part of pupil irregular; pupillary area plugged with a gauze-like pseudo-membrane, which projected conspicuously into the anterior chamber. Aqueous very turbid, slight hypopyon. The scar of the previous injury still visible in the cornea.

* Wiener Med. Wochenschrift, 1874, translated into English by Charles S. Turnbull. M.D., Phila., 1878.

† *Traité des Maladies des Yeux*, Vol. II., p. 312, 2d. éd., 1855.

Patient had eight leeches applied to the temple, atropine instilled every half-hour, and mercurial ointment rubbed into the skin of the limbs. In four days, the inflammation was so far subdued that I could venture to remove the foreign body which had become visible in the pseudo-membrane. I made a corneal section with the lance-shaped knife and drew a chip of iron, together with the membrane enveloping it, out of the eye. Copious hemorrhage into the anterior chamber ensued, but was absorbed in two days. The inflammatory symptoms soon subsided. An opacity remained on the capsule where the foreign body had rested. Eleven days after the operation, the patient was discharged cured, and in the enjoyment of good sight.

It is not entirely clear, from the history of this case, whether the foreign body had lain in the eye sixteen years or six months, for the patient mentions two injuries; but the former, longer interval seems much more probable, since the patient remembered the first accident very well, and furthermore alleged that the second had been a trivial matter; moreover, inflammation set in not immediately, but as late as four months thereafter.

In all probability, the second injury was only a foreign body on the cornea. The case is at any rate distinguished by the perforation of the cornea by a chip of iron which rested on the anterior capsule, produced plastic inflammation (iritis) encapsulating the foreign body, then disappearing, and afterward recurring with great intensity. I cannot suppose that the foreign body had opened the capsule of the lens and remained lodged in it; for, in the description of the case, no opacity of the lens is mentioned, but only the opacity upon the capsule, and the discharge of the patient with good sight.

Cases of foreign bodies *in the lens* are not rare. If the foreign body is small and not in contact with the iris; the consequence is usually only an insignificant or moderate and transitory irritation produced by swelling of the lens. If the opening in the capsule is small, it generally closes in a few days or weeks, and the foreign body may for years remain quiet in the opaque lens. The best thing to do is to abstain from operation until the inflammatory symptoms have passed and the cataract is mature. The extraction of the cataract can be performed when deemed most opportune.

CASE V.—*Chip of iron in lens producing cataract; successfully removed with the lens seven months later.*

In October, 1869, a man, æt. 39, came into the Dispensary of the New York Ophthalmic and Aural Institute, after a chip of iron had flown into his eye a few days before. There was moderate circumcorneal injection, a small closing wound a little below the centre of the cornea, the anterior chamber shallow, the pupil narrow, the iris discolored, the anterior capsule lacerated, and in the anterior cortex, near the inner edge of the pupil, a small, dark, foreign body, which I presumed to be a piece of iron, since the man had been hammering iron when the accident occurred. I ordered atropine instillations, leeches to the temple, and rest in a darkened room. In several days the pupil was wide, and the circumcorneal injection very slight. The wound in the capsule closed, the lens was cataractous, swollen for months, as a spontaneous cataract at this age is apt to be; then it shrank. Seven months after the injury, when the cataract was mature and no longer swollen, I extracted it in the usual manner with a good result (S. $\frac{2}{3}$). The chip of iron could be noticed in the lens during the maturing of the cataract, and also during its extraction. It came out with the cataract, and was hardly 1" long.*

CASE VI.—*Powder-grain in lens. Cataract. Removed with the lens by suction-instrument. Good result.*

In another case where I had to deal with a swollen cataract, in consequence of a powder-grain that had entered the eye of a young man and lodged in the lens, I made an incision of 1" to $1\frac{1}{2}$ " near the outer edge of the cornea, cut out a piece of iris, and removed the lens with a Bowman's suction instrument. The powder-grain was visible in the cataractous mass, and I could also notice its entrance into the orifice of the canula. The removal of the lens was not complete, plastic iritis ensued, and a subsequent division of the secondary cataract was required to clear the pupil.

I may be permitted here to remark that the suction method of soft cataracts, still practised at Moorfield's Hospital, has not given me so favorable results as the method by absorption, which, of course, requires more time. I have, therefore, not performed it any more during the last ten years. Even in soft

* This case is briefly recorded as No. 20 in the tabular statement of 200 cataract extractions, which I published in the sixth volume of these ARCHIVES, p. 320.

cataracts inclosing small foreign bodies, I would not resort to it again, but prefer the modified linear extraction through a large corneal section. The foreign body, I think, will not fail to be liberated with the lens, if care be taken that the cataract can escape "*en masse*," which will be effected by holding the posterior lip down with a spoon, and pressing with another spoon or hard-rubber curette on the opposite periphery of the cornea, in the direction toward the centre of the globe. In this way the wound will be made to gap largely. If it should, nevertheless, happen that the foreign body remains somewhere in the anterior chamber, I would try to remove it with the grooved hook (see below).

If larger foreign bodies produce a severe reaction or cause the lens to split in pieces, with which the foreign body is liable to fall into the anterior chamber, the lens and foreign body should be extracted without delay. In doing this, it is appropriate to make the corneal section large. If that portion of the lens which incloses the foreign body adheres to the capsule or iris, or if, on the other hand, the cataractous substance in which the foreign body is suspended is very soft, then there is danger that the foreign body remains in the eye, while the cataract is readily expelled. In such cases it is advisable first to remove the foreign body with a grooved hook or a pair of anatomical forceps, and then complete the extraction of the cataract. If the foreign body is lodged visibly in the posterior cortical layers, two methods of extraction may be found useful, of which Hulke and A. v. Graefe have furnished examples.

In Hulke's case* a splinter of iron had penetrated the periphery of the cornea and iris, and lay in the posterior cortical substance below the nucleus. Hulke introduced a cataract needle through the cornea and lens behind the foreign body, and pushed the foreign body into the anterior cortical substance. Then he made a corneal section, removed first the foreign body with a curette, and then the cataract. Recovery without irritation. Vision good.

* Ophthalmic Hosp. Rep., I., No. 6.

In Graefe's case* a splinter of metal, about $\frac{2}{3}$ " in length, lodged in the posterior cortex, opposite the outer edge of the dilated pupil. The accident had occurred $1\frac{1}{2}$ weeks previously. A small corneal scar and a small rupture of the capsule were present. Graefe dilated the rupture with the needle. The lens swelled, the foreign body gradually moved forward, and, surrounded by lens matter, projected into the anterior chamber three weeks later. Lest it fall to the bottom of the chamber or adhere to the iris, Graefe made a linear section, passing the knife behind the protruding lens-substance. The foreign body and the protruding portion of the cataract came out as soon as the knife was withdrawn, and the remainder of the lens was then expelled in the usual manner. $1\frac{1}{2}$ weeks later, perfect recovery.

Smaller foreign bodies which are surrounded by lens substance generally cause no irritative symptoms at all. They may be left in the eye undisturbed when the capsule has closed over them.

CASE VII.—*Chip of iron encapsulated in the lens. No reaction.*

To illustrate this, I will mention the case of a boy of five years of age, son of Mr. H. M., of Raleigh, N. C., who was brought to me in September, 1872, after a chip of iron had entered his eye three years previously. It had caused no inflammation, and when I examined the eye I found it normal in shape and tension, the crystalline lens so far absorbed that I recognized the fundus oculi through the upper and lateral parts of the pupil, while in the lower the foreign body was still discernible in a whitish substance. It was safely encapsulated.

The interior of the lens-capsule is, in fact, the only place in the eye to which an extraneous body may be intrusted for a length of time. And even this cannot be said without reserve, for some examples are known in which a foreign body, encapsulated and quiet for years, at once and without any assignable cause produced the most intense inflammation. The same observations have more frequently been made with extraneous

* His Arch., II., 1, p. 229, and in extract by Zander and Geissler: *Injuries of the Eye*, p. 188.

bodies which had lain quietly encapsulated for shorter or longer periods in the retina or other parts of the eye. An example of the former condition is reported by Sämisch.* A small piece of basalt rock had lain quietly in the eye for twelve years, when iritis with cloudiness in the pupil and anterior chamber ensued. The foreign body was extracted from the secondary cataract. Recovery.

It frequently happens that a foreign body enters through the cornea into the interior of the eye, and it is impossible to determine its seat. A hole in the iris or the lens-capsule indicates that it penetrated into the lens, but we are unable to make out whether it remained in the lens or proceeded behind it. As soon as the presence of a defect in the upper part of the visual field reveals a corresponding detachment in the lower part of the retina, which foreign bodies sunk to the bottom of the vitreous chamber generally produce, the question in most cases is no longer as to the removal of the extraneous substance, but of the globe. During the first time, however, the visual field is complete and the inflammatory reaction slight, and as the opacified crystalline lens shuts off the posterior part of the eye, we are unable to track the foreign body further than to the lens. Whether it has been arrested there, or penetrated more deeply, the future will reveal. Intense inflammation and increase of tension of the globe setting in, may be occasioned by swelling of the lens, iritis, and consecutive glaucoma, or by beginning purulent choroiditis. In such cases the lens should at once be removed, but before the surgeon begins to operate, he should ask the patient or his relatives for discretionary power at once to enucleate the eyeball if, after the removal of the lens, the foreign body be not detected.

CASE VIII.—*Foreign body in retina : not found on extraction of lens ; immediate enucleation of eyeball.*

Only a few weeks ago, a typical case of this kind came under my observation. A man, æt. 33, while hammering the hoop of a barrel, noticed that something struck his eye. A small piece at the edge of

* Zeh. Klin. Mon., III., p. 46-51, 1865.

the hatchet was wanting, and the fresh surface showed that it had but recently been broken off. There was a small closed wound in the centre of the cornea and a corresponding rupture in the capsule. Cataract. Tn., F. complete, very moderate irritation. *Diagnosis*: foreign body in the lens or deeper. *Treatment*: antiphlogistic and expectative. On the ninth and tenth days, violent pain in the eye and head, loss of sleep and appetite. T2, F. complete, slight chemosis, oedema of lids.

Probable Diagnosis.—Incipient purulent choroiditis, *i. e.*, panophthalmitis. Eserine reduced tension and pain for five hours.

Treatment.—The soft lens completely removed by linear extraction. No foreign body being found, immediate enucleation of the globe. When the eye was opened, a small piece of steel, one line in length, was found in an isolated pustule at the posterior part of the fundus, near the optic nerve. Excepting the above-mentioned pustule and marked venous congestion of the retina, nothing abnormal was found in the posterior part of the eye.

If the foreign body, which can be seen in the lens, remains in the eye after the extraction of the cataract, a large iridectomy should be made, and the foreign body sought for and extracted with the grooved hook, as C. S. Jeaffreson did in one case with complete success.*

III. *Foreign Bodies upon and in the Iris.*

Several very interesting cases of this kind, taken from the literature up to 1863, have been compiled by Zander and Geisler.† The examples of spontaneous *expulsion* through the cornea,‡ or *absorption* (in particular, of broken points of cataract needles) and *encapsulation* of foreign bodies with preservation of good sight are so exceptional that they can hardly influence our treatment.

In all cases in which the seat of the foreign body can be ascertained upon or in the iris, we should remove the foreign

* See his instructive article on Foreign Bodies Lodged in the Eye, *Medical Times and Gazette*, March 28th, 1874, page 342, case 7.

† Page 160, etc.

‡ Dixon, *Dublin Quarterly Journal*, page 210, 1848.

body either with or without iridectomy. If it lies loosely upon the iris, it may, after the corneal section, escape with the aqueous: some examples of this kind are reported. But even while keeping this fortunate occurrence in mind, we should always arrange the operative procedure in such a way as to admit of a sure and gentle removal of the foreign body by instruments.

In making this section, a Graefe's or, still better, Beer's cataract knife is preferable to the lance-shaped knife, and the section should, to a certain degree, have the curve of the old flap, since the flap, on account of its easy opening, facilitates the manipulation of the instruments and offers the smallest obstacles to the expulsion of the foreign body. Corneal wounds of a moderate extent in an otherwise healthy eye have but little tendency to suppuration. We need not, therefore, be afraid of making the section too large. It might even be recommendable to raise the flap (which should always lie immediately below the foreign body) with a blunt-pointed probe or squint-hook, thereby exposing the foreign body and rendering its removal easier. The patient should be operated in the recumbent position under an anæsthetic, and his pupil should be kept narrow by eserine instillations before and after the operation. This prevents the foreign body from falling into the sinus of the anterior chamber, and obviates as much as possible the prolapse of the iris.

If we have reason to suppose that the foreign body lies loosely upon the uneven anterior surface of the iris, it will be appropriate, while making the corneal section, to hold the blade of Beer's knife, not parallel to the iris, but in such a manner that its upper face forms with it an angle of about 140° , and lies underneath the foreign body, in order to enable the foreign body to escape with the aqueous, and preventing it from falling to the bottom of the anterior chamber.

In the removal of foreign bodies the following instruments have been used: a, *forceps*; b, *spoons*; c, *curettes* and *hooks*. Toothed forceps should only be employed when the foreign body is not hard, for instance when it consists of wood, so that the teeth of the instrument can be pressed into it, whereas

from hard bodies:—metal, stones, etc., they slide off, and the foreign body is pushed more deeply into the iris and lens. The foreign bodies may be better seized by delicate but strong anatomical (grooved) forceps, and if we have to deal with round bodies, for instance bird shot, it may be advantageous to use a pair of forceps the ends of which are hemispherically hollowed out, like the bullet forceps of surgeons. Yet it may be difficult to make them delicate enough to be introduced and manipulated in the anterior chamber. Daviel's spoon may be very appropriate in some cases, and has, for instance, rendered good service to Prof. Horner, as he tells us in his valuable paper on "Foreign Bodies in the Iris, four cases."*

In the majority of cases, however, a curette will be preferable to either the spoon or forceps, since its point admits of seizing the foreign body from behind, thus affording a firmer hold of it and avoiding the danger of forcing it more deeply into the eye. In some cases, it will be best to draw the foreign body with the grooved hook into the wound, and if it be there retained in consequence of its angular edges, to keep it pressed against the wound from behind until it is securely seized and extracted with pincers or pried out with a Daviel's spoon.

CASE IX.—*Iron splinter in the iris extracted with hollow hook.*

Five years ago, a Swiss workman in an iron factory came to me at 9 o'clock in the evening. A piece of steel had struck his eye that afternoon. He had a small wound in the lower half of the cornea. The anterior chamber was incompletely filled and a splinter of metal, about $1\frac{1}{2}$ " in length, lay on the iris a little underneath the pupillary edge; the pupil was narrow, regular, and clear; sight good. I at once undertook to remove it, placing the patient in a half recumbent position on the operating chair in the ophthalmoscope room, illuminated, with a forehead mirror, his eye which was kept open by the ordinary wire speculum. Steadying the eye with the fixing forceps, I made a corneal section under the wound with a Beer's cataract knife. Then I introduced the grooved hook into the chamber, behind the foreign body, which was seized and extracted without difficulty. A small pro-

* Zehn. Klin. Mon., 1863, page 395, etc.

truding part of iris was replaced with a probe. The pupil was round. I instilled atropine, bandaged the eye, kept the patient as a guest in my residence for two days, and had the pleasure of sending him home with a round pupil and perfect vision.

In former years, I used for the extraction of foreign bodies the broad blunt hook which v. Graefe recommended as a traction instrument in certain cases of cataract extraction by his peripheric linear section. Later, I had this instrument changed in such a way that its concave surface was hollowed out and roughened to seize foreign bodies more securely than by the instrument with smooth and convex surfaces from which extraneous bodies are more apt to slide off. This little instrument has been manufactured and sold for several years by Messrs. Tiemann & Co., and some other American and European instrument makers, for instance, Windler in Berlin, Leiter in Vienna.

If the foreign body is situated more deeply in the tissue of the iris, and attempts at seizing it with the hollow hook or forceps have failed, it should without further deliberation be drawn out together with the piece of iris enveloping it, and the iris cut off. This, for instance, is illustrated in a case of Dr. T. R. Pooley, in which a chip of iron had lain in the iris one week and produced iritis with hypopyon. He extracted it with Liebreich's forceps, after having failed with the hook. Abscission of the prolapsed and lacerated iris. Recovery. (Transact. N. Y. State Med. Soc., 1875, p. 194.) This mode of removing foreign bodies in the iris has, of late, been highly recommended. It is the surest and simplest, but also, if the expression may be allowed, the cheapest *modus operandi*. Every oculist has the instruments necessary for this operation always at hand and is familiar with the procedure, but it causes a large coloboma, which is commonly directed downward—an inconvenience which should be a sufficient reason for every operator to give his earnest attention to a method of removing foreign bodies without iridectomy. Though foreign bodies are more frequently met with in the iris than in any other membrane within the eye, and a number of successful

removals have been made known, yet I would beg leave to report two other cases in my own practice in corroboration of the preceding remarks.

CASE X.—*Piece of iron in the iris which could not be removed with forceps, but was easily extracted with the hook. Recovery.*

On the 23d of December, 1865, Theodore Wüstel, of Kohlenfeld near Rastett, entered the clinic at Heidelberg. Four weeks previously, a small piece of iron entered his eye, since which time the eye had been inflamed. In the upper part of the cornea, a superficial loss of substance was seen, resulting, the patient alleged, from the endeavors to remove the foreign body. In the inner upper part of the iris there was a black point, not distinctly recognizable as a foreign body on account of the dullness of the iris and turbidity of the aqueous humor. In the hospital, his iritis increased and hypopyon formed, for which a paracentesis of the anterior chamber was made December 27th. The inflammation abated, the hypopyon disappeared, and the presence of a foreign body could be ascertained. On Jan. 1st, 1866, I made an opening into the lower part of the cornea with a lance-shaped knife, endeavored to seize the foreign body with a pair of delicate iris forceps, but failed; then tried to extract it with Graefe's broad hook, and succeeded at the first attempt.

The foreign body proved to be a black needle-shaped piece of iron, $1\frac{1}{2}$ lines in length, which was loosely covered with a white, viscid coating. After the operation, the iris showed a defect $\frac{2}{3}$ of a line in diameter, which was probably produced by the forceps. The pupillary edge was intact; no bleeding; anterior chamber in part rapidly restored; recovery good. Nine days after the operation the patient was discharged with a round pupil dilated by atropine, clear lens and cornea, and good vision.

CASE XI.—*Removal of two small pebbles from the anterior chamber; the one with a blunt hook, the other by means of iridectomy. Recovery.*

Charles Glück, 30 years old, of Unteroewisheim near Bruchsal, came to the Heidelberg Ophthalmic Clinic on Nov. 14th, 1867, stating that a week ago a foreign body had struck his eye. *Status præsens*: Great circumcorneal injection, photophobia, intense pain; a linear scar in the vertical meridian of the cornea. Anterior chamber filled; iris hyperæmic, dull; a grayish-red piece of stone lies on the posterior surface of the cornea, a similar one on the iris near the lower ciliary border.

I made an incision in the lower edge of the cornea, introduced a blunt hook, and drew out without difficulty the piece of stone which lay upon the posterior surface of the cornea. The other piece of stone had protruded together with the iris. It was seized with the iris enveloping it, drawn clear of the wound, and the iris abscised. Recovery perfect; pupil dilated by atropine; lens uninjured; patient discharged with good sight six days after the operation.

IV. *Foreign Bodies in the Sinus of the Anterior Chamber.*

The bottom of the anterior chamber is the usual resting-place of round and heavy bodies—for instance, small shot—that may have entered the anterior chamber. Yet it is much more frequent that such bodies continue their course, penetrating into the iris and lens, or still more deeply, if the propelling force has been sufficient to overcome the resistance of the cornea. On the other hand, it is not at all infrequent that foreign bodies, lodged deeply in the cornea, are forced by unskilled hands into the anterior chamber and sink to the bottom, where it is difficult to see and still more difficult to dislodge them. I have observed several such cases. In one instance I succeeded, without making an iridectomy, in extracting by means of a hollow hook passed through a corneal section, a small piece of stone from the chamber sinus, where it was imbedded in the tissue of the iris. It has also happened to me once to mistake a small black particle, enclosed in exudation at the bottom of the anterior chamber, for a piece of iron which had penetrated the eye and could not be found. It was only when I had touched the supposed foreign body with the hook that I became aware of the mistake. Desmarres,* in such cases, recommends to make a very peripheric cut through the scleral border with a cataract knife, and to extract the foreign body with a curette. This procedure should be combined with iridectomy, even though we now possess in eserine a powerful myotic, for in such peripheric wounds, prolapse and incarceration of the iris can hardly be avoided. Only lately I saw a very sad instance (sympathetic iritis) illustrating the well-known danger attending incarcerated iris.

* *Traité*, vol. II., p. 314.

V. Foreign Bodies in the Posterior Chamber.

I have no experience of my own in such cases, and, dreading controversy, I refrain from criticising that of others. In opposition to the opinion of Helmholtz, which is derived from examinations of the living physiological eye, and assumes that only a minimal quantity of liquid exists between the zonule of Zinn and the capsule on the one hand, and the iris on the other, almost all oculists consider as the orthodox eye the eye of Arlt, which is constructed from anatomical examinations of frozen specimens, and provided with a spacious posterior chamber. Nevertheless, from a practical point of view, I believe that, whenever there is a considerable space between the periphery of the lens and that of the iris, it is the result of pathological action, *id est*, morbid products. To assume that a foreign body may penetrate the anterior chamber, be arrested by the unbroken anterior capsule, and fall into the posterior chamber, is, in my opinion, not only unproven, but almost impossible, since everybody knows that, at the pupillary edge at least, the iris is closely applied to the lens.

I have repeatedly seen that foreign bodies in the anterior chamber, by unsuccessful attempts at removal, have been more deeply forced into the peripheric tissue of the iris, even so deeply that they could no longer be seen. Violent inflammations ensued, during which a plug of pus sometimes protruded from behind the iris into the pupil. In all such cases I have assumed that the foreign body lay in the periphery of the iris and the head of the ciliary body, and I have never ventured to attempt its removal, since in the cases which came under my observation, the site of the foreign body could not be ascertained with sufficient certainty. Nevertheless, if a similar case should again come under my care, I would make a broad peripheral iridectomy, and if the foreign body should not come out with the iris or be visible after the iridectomy, I would carefully and gently probe the adjacent ciliary region.

If by this manœuvre I chanced to touch the foreign body, I would try to extract it with the hollow hook, but in case of failure I would at once enlarge the sclero-corneal section and

poultice the eye, in order to produce suppuration of the globe. Such a procedure was first practised by Barton, of Manchester, and described by Crampton in the *London Med. Gaz.** I find it quoted in the text-book of W. Lawrence,† and it is recommended by McKenzie and Arlt (*Injuries*) in lieu of extirpation of the globe in such cases where the foreign body in the interior of the eye cannot be found, and keeps up a painful inflammation which may affect the other by sympathy. Barton's method consists in making an ordinary corneal flap which is cut away with scissors. After that, poultices are applied to the eye. In a short time, the foreign body is expelled by the ensuing suppuration. The painfulness, which, after extensive opening of the globe, is commonly not very great, and can be rendered tolerable by anodynes, is more than counter-balanced by the resulting good stump. Yet in the choice between this procedure and enucleation, the age, sex, and social condition of the patient should be taken into account.

B.—FOREIGN BODIES IN THE VITREOUS CHAMBER.

The reactions produced by foreign bodies that have entered the posterior part of the globe and remained either in the vitreous chamber or its walls, the retina, ciliary body, choroid, and sclerotic, are illustrated by numerous examples both in the earlier and modern literature (Edw. v. Jaeger, *Wiener Krankenhausbericht*, 1857 and 1858. A. v. Gracfe, his *Archiv*, Vol. III., 2. R. Berlin, and others). But the number of cases in which foreign bodies have been removed from the posterior part of the globe is very small. J. P. E. Ballias, in his paper, "*Des Corps Etrangers du Corps Vitré*,"‡ has compiled fifty cases, in twelve of which the extraction of the foreign body had been attempted, in three with success. He adds no new cases, and gives no notes of those used in his statistics.

The cases of successful or only partially successful removal of foreign bodies from the vitreous chamber and its walls are so rare that they may be considered almost as exceptions.

* Vol. 21, p. 175.

† 2d Ed., p. 145, 1844.

‡ Thèse de Paris, 1865.

The reason of this is chiefly to be attributed to two conditions: *first*, the patients present themselves to the physician only when an exact determination of the site of the foreign body is no longer possible; *secondly*, the operative procedures have not yet been sufficiently perfected.

The influence of both these conditions diminishing from year to year, I feel confident that in future a relatively greater number of successful extractions of foreign bodies from the posterior part of the globe will be made known. Zander and Geissler have compiled the respective cases up to the year 1864. They are six in number: three cases (v. Graefe, 1; Ed. Jaeger, 2) in which the foreign body had pierced the coats of the eye, but remained impacted with one end in the sclerotic, while the other projected into the vitreous. In the first two cases, the foreign body was detected soon after the injury, and drawn out with forceps; in the third, the foreign body was not found, but later an inflammatory intumescence (partial choroiditis) occurred at the injured place, showing an almost black coloration of the sclerotic to the extent of $\frac{1}{2}$ ". When, thirty days after the injury, an incision was made in this place, the foreign body was felt with a delicate probe, and extracted. In these three cases, recovery with preservation of sight ensued.

In the fourth case,* the foreign body had penetrated into the vitreous through the cornea and iris. Critchett, after having extracted the opaque lens, saw an oblong piece of metal behind the hyaloid fossa. It could not be seized with forceps, but was drawn out with a curette, not without escape of vitreous. Final result not stated.

In the fifth case, Desmarres seized a fibrous cord, which proceeded from a foreign body that was movable in the anterior part of the vitreous, with a pair of forceps which he had introduced through a scleral opening; after wrapping the fibrous cord around the forceps, he extracted a small piece of copper connected with the cord, measuring 2" in length and 1" in breadth. The eye became free from pain, but atrophic.†

* Critchett: *The Lancet*, April, 1854, p. 858.

† *Annales d'Ocul.*, XXIII., p. 16; Zander and Geissler, p. 217.

The sixth case, of Dixon,* has been often quoted. A foreign body had pierced the upper lid and sclerotic. It was not until four weeks later that a dark oval foreign body was seen in the anterior inner part of the vitreous. It moved with the eye, and could be drawn toward the wall of the globe by a large magnet. Dixon thrust a lance-shaped knife through the sclerotic, perpendicularly to the direction of the fibres of this membrane, seized and extracted with Assalini's forceps, after two unsuccessful attempts, a chip of steel of 1 mm. in length. Good recovery. A small cord in the vitreous was still visible after one month and a half.

I have collected the cases recorded in modern literature from Cannstatt's (*i. e.*, Virchow-Hirsch's) and Nagel's Annual Reports, and looked them up in the original publications as far as they were accessible to me. Since their number is limited, I do not deem it entirely superfluous to cite them in short extracts.

R. Berlin reports† a case which is very remarkable from an operative point of view. A lad of fifteen years had been injured two weeks before he presented himself. The interior of the eye was not visible on account of inflammatory turbidity. S. = $\frac{1}{2}$, T. increased. Two lines behind the inner edge of the cornea, a circumscribed swelling of conjunctiva. When Berlin enucleated the eye, and had divided the internal, inferior, and external recti muscles, he met with a foreign body lodged in the posterior outer part of the sclerotic, and extracted it. It was a small splinter of iron with sharp edges, and had $2\frac{1}{2}$ ''' in length, 1''' in breadth, and 1''' in thickness. Dr. Berlin, after having satisfied himself, by probing with a squint hook, that no foreign body was left in the scleral wound and the adjacent part of the vitreous, united with sutures the tendons of the external and inferior recti again to the globe, and closed the lids by a compressive bandage. He left the tendon of the internal rectus untouched, since he was afraid (without sufficient reason) of diminishing the chances of recovery by applying too many

* Ophthalm. Hosp. Rep., I., p. 280.

† Zehend. Klin. Mon., IV., 1866, p. 81, ff.]

sutures. The result was a complete reattachment of the globe but slight atrophy and divergent squint, S.=0. The foreign body had evidently entered the anterior part of the sclerotic, passed through the vitreous, pierced the posterior wall of the globe, but had remained partially impacted in it.

This case suggests the possibility of coming across the foreign body even during the enucleation. Therefore, the first step of our operation should always be directed towards the supposed site of the foreign body.

As a curiosity, I beg to mention a case of A. v. Graefe's, in which, after the enucleation, a foreign body was found in the optic nerve 2''' behind the sclerotic. The foreign body had penetrated the cornea, and passed through the cavity of the globe and the optic disc into the optic nerve.

Foreign bodies that enter the globe at its anterior part have sometimes been found encapsulated and harmless in the background of the eye (E. Jaeger, A. v. Graefe, Hirschberg, and others).

In a case of G. T. Stevens,* of Albany, a foreign body was extracted from the retina. A fragment of iron, broken off from a hatchet, entered the eye through the periphery of the cornea and iris. Two weeks later, Stevens recognized it by its metallic lustre. It lay in the retina, behind the equator of the globe. Having by means of the ophthalmoscope determined the site of the foreign body as accurately as possible, he thrust a fine needle into the eye at the supposed place of the foreign body, and the ophthalmoscope showed the needle projecting into the vitreous just at the anterior border of the foreign body. After making a meridional opening into the sclerotic, he saw the foreign body, surrounded by retina, presenting in the wound. With a pair of forceps, he drew forth the foreign body together with a piece of the retina and removed it. Two weeks later, the eye showed a defect in the visual field corresponding to the place of the operation. Two day after this, intraocular hemorrhage occurred. Two months

* Trans. Amer. Ophth. Soc., 1875, page 308.

after the operation, the media were still so turbid that the optic disc could not be seen.

A case of Schöler, published in the second annual report of his Ophthalmic Institution (pro 1874), is known to me only from the extract which Manz published in Virchow-Hirsch's Ann. Rep. on the Progress of Medicine. It reads as follows: "Schöler advises, in cases in which foreign bodies penetrated into the vitreous through the lens, to make linear extraction and seek for the foreign body under the condition that perception of light and the visual field are preserved, and that no dangerous symptoms of irritation are present. In one such case he succeeded in extracting a guncap, and the eye recovered good vision."

A case reported by Sp. Watson,* is very remarkable. A bird-shot had pierced the sclerotic 4''' downward and inward from the cornea, and lay in the eye for two weeks. Opacities of the vitreous. Sight lost. Violent pain. When an "iridec-tomy was made, the bird-shot fell out. The exit of the shot far in front of the place of perforation in the sclerotic is most remarkable. Watson thinks that the bird-shot may have moved forward and downward by its own weight."† According to the important investigations of R. Berlin, we may suppose that it struck the posterior wall of the globe and was repelled.

Concerning a case of Hansen, I find, in Canstatt's Jahresbericht, only the following short note: "Hansen reports a case in which he removed, by means of modified linear extraction, a guncap from the vitreous chamber."

Dr. R. Berlin, in his first paper,‡ "On the Course of Foreign Bodies that have Entered the Vitreous," states that he has twice performed the extraction of foreign bodies from the vitreous. The paper, however, makes no further mention of these cases, unless the statement on p. 307, l. c., refers to one of them. "The attempt to extract the foreign body, after enlarging the wound, failed. The foreign body was only pushed

* *Lancet*, 1872, II., page 598.

† Nagel, *Jahresbericht*, 1872, page 473.

‡ *Graefe's Archiv*, XIII., 2, p. 275, etc., 1867.

downward and out of sight." It remained in the eye, and caused detachment of the retina.

The masterly second paper* of R. Berlin contains more data pertaining to our special subject. In one case (loc. cit., p. 277), a small scar was situated just above *lower* the corneal margin. Lens opaque. Five lines behind the *upper* corneal margin, a red swelling, sensitive to the touch; corresponding to it a circumscribed defect in the lower part of the visual field. The injury had occurred a week previously, from the explosion of a gun loaded with a blank cartridge. Eleven days after the accident, Berlin opened the swelling on the superior wall of the globe, and removed a fragment of a guncap, one square millimeter in size, imbedded in a small collection of pus lying between the sclerotic and the tendon of the superior rectus. Recovery. The guncap had passed through the cornea, lens, vitreous, and sclerotic, and had been arrested by the tendon of the muscle. Patient was discharged with quantitative perception of light and cataract.

Berlin's investigations led him to the conclusion that a small number of the foreign bodies that enter the vitreous chamber lodge in the retina and choroid at the posterior part of the globe; whereas the greater number are repelled in such a way that the lighter ones—for instance, thin scales of metal—float in the vitreous; but the heavier ones, especially pieces of iron, sink to the bottom, and are commonly situated between the equator and ciliary body.

They may be sometimes diagnosticated by the sensibility of the sclerotic to the touch, but more frequently by corresponding defects in the visual fluid. They can be directly reached through an opening into the sclerotic, three lines behind the corneal margin.

In two such cases, Berlin has attempted their extraction. In the one (l. c., p. 321), he made a circular section, three lines in length, four lines and a half behind the cornea, and while cutting distinctly felt the foreign body with the knife. He passed a

* Observations on Foreign Bodies in the Vitreous Chamber. Graefe's Arch., XIV., 2, p. 275, etc., 1868.

pair of forceps and a probe through the section into the posterior part of the vitreous chamber, without, however, finding the foreign body, which, as the examination of the subsequently enucleated globe showed, was situated just in front of the circular section.

In the second case (p. 325), he made, three lines behind the cornea, a circular cut, four lines in length. A piece of iron, three lines long, half a line broad, presented at once, and was easily extracted. The eye grew phthisical.

In these ARCHIVES,* Berlin reports two cases in which he removed extraneous bodies from the vitreous chamber. In the first, he availed himself of the large corneal wound which the foreign body had made. In the second, he extracted the lens after an iridectomy, then opened the hyaloid fossa, probed for the foreign body, and extracted it with forceps. Both eyes, of course, were ruined.

J. F. Jeaffreson, in an instructive paper,† reports a case of successful extraction of a small piece of iron from the vitreous. It flew from a lathe, and entered the eye through an opening one line and a half behind the cornea, "where, after the dilatation of the pupil, it could be seen in the vitreous, a little above and to the nasal side of the visual axis. A fine pair of canula forceps was passed along the track of the wound until it came in contact with the foreign body. The blades were then opened, and it was seized and removed without difficulty. For some weeks after, the vitreous was very hazy, and then began to clear up. At the discharge of the patient, two months after, $V.=\frac{1}{10}$."

In conclusion I have to mention a case distinguished by the use of a magnet for the extraction of the foreign body. Wm. A. McKeown relates‡ that he detected with the ophthalmoscope a chip of steel, shortly after it had entered, through the periphery of the cornea and iris, deeply into the vitreous

* Vol. I., p. 30, etc.

† On Foreign Bodies in the Eye. *Med. Times and Gazette*, March 28th, 1874, p. 342, Case 6.

‡ *Brit. Med. Journ.*, June 20th, 1874.

body. The day after, inflammation and opacity of the vitreous. McKeown made an opening into the sclerotic, two lines and a half in length, and two lines and a half behind the outer corneal margin. After having failed to extract the foreign body with iris forceps, he introduced the two rounded united ends of an eight-inch horse-shoe magnet into the wound toward the posterior pole of the globe. The foreign body was attracted by the magnet, but on withdraw-it, it was twice arrested by the sclerotic. At the third attempt, however, it was successfully extracted. Three days after, the patient could leave the hospital. Four weeks after, he had S.= $\frac{1}{2}$ and a small limitation of the visual field toward the nose, probably produced by a detachment of the retina. (This case is quoted from R. Berlin's review in Nagel's Jahresbericht, 1874, p. 579.)

To these preceding cases I can add three from my own practice, in which I succeeded in extracting foreign bodies from the vitreous. I have extensive notes of two of them, one being still under my observation. I have not been able to find the history of the third in my books, still I remember its essential features.

CASE XII.—*Foreign body in vitreous, removed with blunt hook. Recovery, leaving cicatricial cord.*

The patient, a boy, son of the janitor of the old University Hospital at Heidelberg, came to me a few hours after a foreign body, a guncap, if my memory serves me, had entered his eye. A small wound in the outer part of the sclerotic was kept open by a bead of protruding vitreous. With the ophthalmoscope I saw the foreign body floating in the vitreous, and proceeded at once to remove it. Armed with a forehead mirror, I illuminated in the ophthalmoscope room the interior of the eye, while an assistant steadied the head of the patient who was sitting. I passed a blunt Graefe's hook through the wound into the vitreous behind the foreign body, which I drew to the scleral wound; there it was arrested, but a part of it presented in the wound so that I could seize the foreign body with a pair of anatomical forceps, and, while the hook was fixing it from behind, extracted it, not without some force. The loss of vitreous was insignificant. I bandaged the eye in the usual

manner, and the scleral wound soon closed. The vitreous body was at first diffusely opaque, but cleared up in several weeks, and the patient could count fingers across the room. Later, I observed more and more distinctly a cicatricial cord arising from the wound and stretching in the direction of the course which the foreign body and hook had taken. I saw the boy every now and then; his eye was free from pain; vision moderately good, and no irritation in the other eye. I do not know what finally became of the eye.

CASE XIII.—*A piece of iron in vitreous, removed with anatomical forceps. Recovery, leaving opacities of vitreous.*

John Schaller, of Ziegelhausen, near Heidelberg, came to the clinic June 19th, 1866, several hours after a chip of iron had pierced the inner part of the sclerotic. He could read Snellen 2.50 on a cloudy day with this eye as well as with the other. After the pupil was dilated, I observed a fragment of bright metal in the anterior outer part of the vitreous, not very far behind the lens, which, impelled by the movements of the eye, made slight excursions; I at once proceeded to remove it. With a lance-shaped knife I made a meridional opening three lines in length in the outer part of the sclerotic, and made two attempts to extract the foreign body—the first by daylight, the second by lamp-light with the ophthalmoscope—but failed both times, the illumination proving insufficient. Then I had the light of a large gas-flame from an Argand burner thrown through the pupil into the vitreous space by means of a lens, and concentrated it upon the foreign body which I could now see well, and tried to draw into the wound with a Graefe's blunt hook, yet could not succeed; then I entered with a pair of anatomical forceps, seized the small piece of iron firmly, and drew it out without any difficulty.

Immediately after the operation the vitreous was turbid, yet I could see the details of the background of the eye, and convinced myself that there was neither hemorrhage nor anything else abnormal. On the nasal side, where the foreign body had entered the fundus, was a bluish hue (detachment of retina [?]); also on the opposite side, where the wound of the operation was situated, I noticed a bluish, but very small fold. The visual power was only superficially examined, the patient could count fingers, and the visual field was not materially contracted.

Rather intense inflammation followed, pain during the night, conjunctiva red and swollen, cornea and pupil clear; posterior portion of

vitreous on oblique illumination presented a dull, grayish, striated appearance. On the third and fourth days after the operation, eyeball slightly protruding; pupil remained wide; iris was not discolored; patient saw movements of the hand; field of vision complete. From the fifth day the eye improved. Four weeks after the operation, patient discharged; counted fingers, had no contraction of visual field. Diffuse opacity was in the whole vitreous, flaky opacities were in its lower part, and membranous opacities arose from the wound.

CASE XIV.—*Guncap in vitreous, removed with grooved hook. Perfect recovery.*

A boy, R. T., of New York, æt. 7, injured his left eye by discharging a toy pistol on June 25th, 1873. I saw him two days later, and found a piece of iris protruding through a small wound in the upper part of the cornea. I observed, through the dilated pupil, about in the centre of the vitreous, a bright metallic body with sharp corners and irregularly curved edges, having an apparent length of $2\frac{1}{2}$ ''' and a breadth of $1\frac{1}{2}$ '''. The vitreous was clear, the background only very slightly veiled, the optic disc and the whole retina hyperæmic; the veins in particular were thick and tortuous; the retina in the vicinity of the disc was somewhat opaque and apparently swollen.

On the same day I extracted the foreign body in the following manner. At first I threw light from a large gas flame into the patient's eye by means of a forehead mirror, which indeed rendered the foreign body distinctly visible. But when I placed the patient in a well-lighted room, opposite the window, I could, without the mirror, see the bright foreign body as well, and preferred this position, since it afforded a free movement of my head during the operation. The patient was deeply anæsthetized, placed horizontally on his right side, the pupil of the injured eye being turned directly toward the window. The lids were kept apart by a wire speculum, and the globe was slightly turned towards the nose with forceps. Then I made with a lance-shaped knife an opening two lines and a half in length through the coats of the eye, a little in front of the equator, and just over the edge of the external rectus muscle. I introduced a delicate but strong pair of anatomical forceps, before which, however, the foreign body escaped when touched. I therefore at once withdrew the forceps from the eye and introduced the above-described grooved hook, passed it behind the foreign body, seized it firmly, and drew it into the scleral

wound, where it was arrested, and slipped from the hook. Since the opening was too small, I enlarged the wound with squint scissors, seized the foreign body anew with the hook, and extracted it without difficulty. Not more than a drop of vitreous escaped. On account of some bleeding from the wound the eye was kept closed for some time. When the patient came to, the wound gaped. He was therefore anæsthetized again, and the scleral wound was closed by a conjunctival suture, a small quantity of fluid vitreous escaping. The protruded iris in the original corneal wound was seized with forceps, drawn out, and cleanly cut off. When the patient had regained his consciousness, he could count fingers well; I therefore instilled a drop of atropine in the eye, then bandaged both eyes, and had him put to bed.

June 28th.—Night tolerably quiet; pain in eye every now and then; thirst; edge of lid somewhat swollen, pale; the whole conjunctiva of the sclerotic uniformly but only moderately swollen, except in the region of the wound, where it is more raised; anterior chamber normal; pupil fully dilated; pulse 100; counts fingers at 6'.

June 29th.—Rested well; charpie moist, not purulent; injections of conjunctiva the same; region of wound, however, less swollen; patient recognizes time at watch; circumscribed defect of visual field on nasal side; pulse 96.

June 30th.—Night good. Some mucous secretion on lint; injection and swelling of conjunctiva less; pupil clear; scar of iridectomy clean; no irritation in scleral wound; background of eye slightly veiled; retina hyperæmic; counts fingers across the room. Defect in visual field no longer recognizable on ordinary examination with hand.

The further course of the case was an undisturbed convalescence. The wound closed on the 7th day after the operation, and the suture was then removed. On the 14th day, S.= $\frac{2}{7}$ %; F. complete. With the ophthalmoscope, a white oval scar, about 2 P. D. in length, was seen at the place of the wound. Patient read Sn. 1 $\frac{1}{2}$ readily. In the upper part of the cornea there was an irregular small scar, to which the iris adhered. Six months after the operation, pupil was oblong, drawn towards the scar. The minor circle of the iris was free in the anterior chamber, the peripheric upper and outer part of the iris united to the scar; lens clear; fundus normal; vitreous without a trace of opacity. The white patch in the region of the wound had quite the appearance of a coloboma of the choroid, was about 2 $\frac{1}{2}$ P. D. long and 1 $\frac{1}{2}$ P. D. broad. It did not manifest itself by a scotoma noticed by

the patient. S. $\frac{2}{3}$ 0; in the other eye, S. $\frac{2}{3}$ 0. T.n., binocular vision perfect.

The eye remained unchanged in this condition for five years, then a serous cyst developed in it, which I removed in October, 1858. In presenting the specimen to the New York Pathological Society, I gave also a brief sketch of the previous history of the patient.* I beg also to state that I shortly mentioned the above case at the meeting of the American Ophthalmological Society, in 1873, on the occasion of the demonstration of the grooved hook and two other instruments.†

A COMPREHENSIVE REVIEW of the preceding observations on the removal of foreign bodies from the vitreous yields the following results. I have not been able to collect more than twenty cases in which a foreign body had been removed from the vitreous chamber.

In the first three cases (v. Graefe, one; Ed. Jaeger, two), the foreign bodies pierced the sclerotic, but remained impacted in it. They were easily extracted. Recovery with preservation of good sight.

Excluding, in the following, these three comparatively simple cases, and considering the other seventeen according to special points of view, we arrive at the following statements:

I. *Entrance and course of the foreign body.*

In *seven* cases, the foreign body entered the vitreous directly through the sclerotic.

In *ten* cases, it entered through the cornea, *id est*, in seven through the lens, in three (McKeown, Stevens, Knapp) through the periphery of the iris without wounding the lens.

II. *Position of the foreign body at the time of the operation.*

In *two* cases (both of Dr. Berlin), it pierced also the posterior capsule of the globe, remaining impacted, in one case, in the sclerotic; in the other, between the sclerotic and the tendon of the superior rectus muscle.

In *one* case (Stevens), it lodged in the retina.

* See Med. Rec., Nov. 2d, 1878, vol. XIV., p. 353.

† Transactions Am. Ophth. Soc., 1873, p. 108.

In the fourteen remaining cases, it was situated in the vitreous body.

III. *Opening of the globe for the extractions.*

In *two* cases (Jeaffreson and Knapp), the original opening of the wound was made use of, but had to be enlarged in one case (Knapp).

In *nine* cases, a new opening was made in the sclerotic, *id est*, four times in a circular (parallel to the equator), and three times (Stevens, one ; Knapp, two) in a meridional direction ; in two cases (Desmarres and McKeown), the direction is not stated.

In *six* cases, the extraction of the foreign body was effected through the cornea, *id est*, in one case (Watson), with simultaneous iridectomy ; in one (Berlin), making use of the original large wound in the cornea ; and in four (Critchett, Berlin, Hansen, Schöler), preceded by a modified linear extraction of the lens.

IV. *Instruments used in the removal of the foreign bodies.*

In *eight* cases, the forceps, among which in one the canula forceps, in another Assalini's forceps.

In *one* (Critchett), a curette.

In *one* (Knapp), a grooved hook.

In *one* (McKeown), a magnet.

In *one* (Sp. Watson), the foreign body dropped out by itself.

In *four*, instrument not stated.

V. *Course and termination of the cases.*

In *two* cases (Berlin, Hansen), the termination is not stated.

In *six* cases (Desmarres, one ; Berlin, four ; Sp. Watson, one), loss of sight which in a part of them was already present before the operation.

In *four* cases (Critchett, Stevens, Knapp two), moderately good vision, when patient was last seen, was stated, with a doubtful prognosis as to the future.

In *five* cases (Dixon, Jeaffreson, McKeown, Schöler, Knapp), vision was good. To these must be added the first three cases in which the foreign body projected into the vitreous

space with one end only. In Dixon's case, the acuity of vision is not stated, but it is said that a small cord remained visible in the vitreous. In Jeaffreson's case, at the discharge of the patient S. $\frac{1}{10}$ is noted with progressing clearing of the vitreous. In McKeown's case, S. $\frac{1}{2}$ with a small defect in the visual field, twenty-eight days after the operation. In Schöler's case, preservation of good vision is noted. In the last case operated on by myself, S. was $\frac{2}{3}$ for five years, then a cyst of the iris developed which was successfully removed, leaving his vision still $\frac{2}{3}$, but the possibility of a relapse cannot yet be excluded.

I will not omit to deduce from the preceding pages some rules as to

PROGNOSIS AND TREATMENT.

The cases in which the foreign body enters the vitreous through the sclerotic are, in general, more favorable than those in which it enters through the cornea. Among the latter, those in which the foreign body passes through the periphery of the iris without injuring the lens are more favorable than those complicated by traumatic cataract. The most favorable, of course, are those in which the foreign body pierces the sclerotic, but remains in it with one end.

As regards the operative procedures, I will first mention the two methods devised by A. von Graefe, and especially practised for the removal of cysticerci, viz.: 1st, the extraction of the foreign body through the cornea, preceded by peripheric linear extraction of the lens, and, 2d, the extraction of the foreign body through an opening in the sclerotic by a circular section. Both methods involve great dangers. The first I consider admissible only when traumatic cataract is present. If, after the removal of the cataract, the foreign body cannot at once be seen with oblique illumination or the ophthalmoscope, three methods of operating are at our disposal: First, we may wait until the wound is healed and the eye has cleared up, to determine the site of the foreign body with the ophthalmoscope, and either trust to its becoming encapsulated, or remove it through a scleral opening. Secondly, we may

with a probe, or, still better, with a hollow hook, search for the foreign body. This procedure, I think, is very hazardous, though it is supported by a successful operation (Schöler), the details of which I am unfortunately unable to look up. Thirdly, the immediate enucleation of the eyeball. This operation I would perform without delay in all cases in which symptoms of violent irritation indicate beginning panophthalmitis. The immediate enucleation, that is, without first extracting the lens, I consider the most advisable in all cases in which we are sure that the foreign body has passed through the lens. The danger of sympathetic affection is not counterbalanced by the slight chance of extracting the foreign body with preservation of a useful eye.

I fail to see what advantage a circular section through the sclerotic may possess over a longitudinal one. A circular section divides transversely the nerve-fibres of the retina, the larger vessels of the choroid, and the principal fibre-tracts of the sclerotic, thus inflicting a far more important and prejudicial wound. As far as my experience concerning wounds of the sclerotic goes, longitudinal sections heal just as easily as transverse sections. The available space is sufficient for a longitudinal section, since a section beginning two lines behind the cornea and ending at the equator or a short distance beyond it, will suffice for the extraction of all foreign bodies from the vitreous. After the operation, the wound should be closed by conjunctival sutures. As far as I am aware, in the extraction of cysticerci the longitudinal section is of late years mostly preferred to the circular section.

In regard to the *choice of the instruments*, the hollow transversely grooved hook might in most cases be given the preference. Toothed forceps are to be decidedly proscribed in the extraction of hard bodies (almost the only ones here met with), and also the transversely grooved forceps might serve more frequently to seize the foreign body after it has been drawn into the wound by the hook than to be introduced into the eye.

If we have to deal with small particles of iron, they may be drawn towards the wound in the sclerotic by a magnet applied

to the outer side of the globe, whereas the introduction of a magnet into the vitreous space (McKeown) appears to me more injurious than the introduction of the hollow hook. The canula forceps and Assalini's forceps have been successfully used, each in one case; but as regards the availability of the former, I have heard many complaints which are confirmed by my own experience, and Assalini's forceps, opening on pressure, might, on account of the unwonted mechanism, in uncertainty of seizure still surpass the ordinary forceps. To thrust a fine needle into the sclerotic, as Stevens has done, in order to determine the site of the foreign body and be a landmark during the operation, seems to be as harmless a procedure as it may be useful; the needle may at the same time serve as a fixing instrument, and for this purpose it might appropriately be made with a knee-like bend, so that during the operation the handle of the instrument and the hand of the assistant are out of the way.

In regard to the *value* of the extraction of foreign bodies from the vitreous chamber, the foregoing statistics—five successful and four moderately successful cases of seventeen—seem to countenance the performance of this operation. If the foreign body lies in the vitreous space, and the corneo-ciliary part of the globe has not been materially injured, the operation may be justifiable even if we cannot hope to preserve the sight of the eye. In making the section, we should bear in mind the results obtained by Dr. Berlin's investigations, in particular that one which demonstrates that heavier foreign bodies almost invariably lodge in the anterior lower portion of the vitreous, and may be extracted through a scleral opening made three lines behind the cornea.

Since the necessity of removing a foreign body from the interior of the eye may devolve upon any oculist, or even upon any practitioner, at any hour, I beg in conclusion to indicate the *armamentarium* required for that purpose.

1st. *A magnifying glass, ophthalmoscope, and forehead mirror.*

2d. *A lid speculum and fixing forceps.*

3d. *A broad needle with one slightly hollow surface, to push back foreign bodies that are lodged in the ocular capsule,*

and either perforate or threaten to perforate it; furthermore to prevent such bodies from falling into the interior of the eye, and from injuring important parts.

4th. *A Beer's cataract knife.*

5th. *An angularly bent, lance-shaped knife.*

6th. A pair of *curved iris forceps* to perform iridectomy.

7th. A pair of *curved (squint) scissors*, to cut off the iris and enlarge the wound.

8th. *A knee-bent delicate needle*, to be thrust into the vitreous for the purpose of "orientation."

9th. *Delicate anatomical forceps.*

10th. A transversely *grooved hollow hook.*

11th. *Needle, thread, and needle holder*, for closing the scleral wound.

It will be apparent that only Nos. 3, 8, and 10 have to be added to the ordinary instrument case of the oculist. The broad needle might be replaced by the cataract knife, and the knee-bent delicate needle might not be absolutely necessary either, but I would not like to be deprived of the hollow hook.

